A Computer Literacy Course for Agricultural Students: A Course Outline and Student Evaluation

Marvin T. Batte, John R. Fiske and Reed D. Taylor

ESS 614

Marvin T. Batte and John R. Fiske are Assistant Professors, and Reed D. Taylor is Associate Professor, the Department of Agricultural Economics and Rural Sociology, The Ohio State University.

It has been suggested that we are on the verge of a business management revolution that will be as important to the future of agriculture as were the introduction of animal power and the subsequent shift to mechanical power and chemical techniques in their own times [8]. The adoption of information processing technology may speed the current structural change toward fewer and larger farms. With narrowing profit margins, greater reliance on manufactured inputs, and increased use of debt financing, the vulnerability of the present day farmer to price and yield variability has heightened. Only those farmers who can control costs and productivity and who can quickly and accurately appraise marketing options will remain profitable. Information processing is likely to be key to this ability and computer literacy may be the prerequisite to effective utilization of information in the management process.

For some time educators have been asserting that computer literacy is as much a part of functional literacy as are the "three R's" [4,6]. While these assertions may be given to hyperbole, they contain too much truth to be dismissed lightly. Indeed, they contain enough truth to warrant a serious assessment of the computer literacy needs of students in agriculture. Teachers in college-level curriculums have close contact with the future leaders of agriculture. It is important that they familiarize themselves with the concept of computer literacy and how best to ensure that their graduates possess it.

This is a report of recent experiences in Agricultural Economics 250 (AE 250), a "computer literacy" course offered in the College of Agriculture at The Ohio State University. The purpose of this report is to summarize student attitudes and performance relative to this important subject matter. The particular objectives of the study are:

1. To measure student attitude toward application of computer technology in agriculture.
2. To test for cnanges in these attitudes resulting from completion of AE 250.
3. To determine factors which affect student performance and attitude in AE 250.

The next section will address the goals and efforts at The Ohio State University to provide "computer literacy" to students in the College of Agriculture. The AE 250 course content will be described followed by a description of student enrollment over recent quarters. Subsequently, attitudes regarding the usefulness of the computer in agriculture held by students both prior to, and following completion of, the course are discussed. Changes in attitudes will be related to characteristics of students enrolled. Statistical tests of differences in attitudes and performance among students by groups will be discussed.

Computer Literacy and AE 250

Growth of interest in computer literacy in colleges of agriculture has paralleled the development of microcomputer technology. This highly accessible, relatively low cost technology seems to be particularly appropriate to the needs of typical agricultural businesses. Full appreciation for this technology, however, requires a basic understanding of the functions, capabilities and limitations of hardware and software and an ability to conceptualize problems for computer solution. This understanding is considered to be an important characteristic of computer literate individuals.

The concept of computer literacy has resisted a single, concise definition. Most educators would agree that computer literacy can be defined as having an understanding of computers and a basic ability to use them. Several authors agree on the following characteristics [2,3,1]:

1) An understanding, in a nontechnical sense of how a computer works and how its component parts are related.
2) An understanding of the capabilities and the limitations of computers.
3) An appreciation for computer applications to a subject matter area.
4) An ability to conceptualize problems for computer solution at an introductory level.
5) An ability to represent problems in the syntax of a computer language.
6) An understanding of the societal impact of computers.

Just as verbal literacy usually connotes the ability to read and write but not necessarily with fluency or creativity, computer literacy suggests a mastery of very basic computer skills.

Writers on the subject have made a distinction between literacy and fluency [5] and literacy and competency [10]. In both cases, the latter quality implies a deeper understanding of computers and better developed ability to employ computers in problem solving. Computer literate individuals would not be expected to know computer architecture or how to configure hardware although they should know the functions of each major class of hardware. They would be expected to have the ability to write simple algorithms, understand what an algorithm is and know its importance to data processing. Computer literacy does not imply the ability to design and code efficient, general purpose programs, although it should imply an understanding of when such standard procedures as looping or branching are appropriate.

The Evolution of AE 250

In the summer of 1981, the College of Agriculture modified its undergraduate curriculum to require a minimum of five quarter hours of credit in computer subject matter. This requirement can be met by completion of either a programming course taught in the department of Computer and Information Science or Agricultural Economics 250. This action was taken in recognition of the changing role of computers in agriculture, and the changing needs of agricultural employers.

The history of AE 250 substantially precedes the college of agriculture curriculum change. AE 250 was created in 1972. It was conceived as a course that would expose department majors to the evolving technology of the computer and the interaction this technology would have with agriculture. In its early days, the course was largely a survey course. Students were not given hands-on experience with computer use and were not required to design and code computer programs. However, from the beginning demonstrations of agricultural applications programs were incorporated through the use of timesharing on mainframe computers.

Over time, both enrollment in the course and its orientation toward hands-on experience grew. In 1979, a laboratory of twenty programmable calculators with printers was added [9]. The course was modified to include an organized laboratory section. The use of programming exercises also was incorporated to promote student understanding of simple programming techniques. Programmable calculator technology proved successful as a method of teaching students the elements of programming. Concepts of conditional and unconditional branching and looping were easily demonstrated with this tool. Students were provided an elementary understanding of the power and application of the computer through this technology.

With the advent of low-cost microcomputer technology, it became feasible to upgrade the computer equipment used in the teaching environment. This was done in the spring of 1983. With the adoption of this more widely applicable technology and the college "computer literacy" requirement, enrollment in the course continued to grow. The course is now offered three quarters each year, with quarterly enrollments of 130 to 190 students.

AE 250 is organized as a five credit hour course under the quarter system. The class meets for 48 minute lectures three times a week and for a two hour lab session once a week. Multiple lab sections are offered in order to achieve a small class environment and to increase the use of available microcomputers. Experience has shown that two students per computer in a lab of 20 computers will provide such an environment [9]. Over a ten week quarter, students meet for thirty lecture hours and twenty lab hours.

The course consists of five major sections, the largest being an approximately four week treatment of BASIC. Other topics include a six-lecture discussion of general purpose computer software featuring electronic spreadsheets, data base managers and word processing. The full outline is as follows:

Section I. Introduction to Computer Technology (4 lectures)

Computers and data processing.

An historical perspective.

The computerization of agriculture.

Management information systems in agriculture.

Section II. Computer Technology (2 lectures)

Computer hardware.

Computer software.

Section III. Problem development and program design (3 lectures)

Program development cycle.

Elements of structured programming.

Flowcharting techniques

Section IV. Programming in BASIC (13 lectures)

Data input and output.

Arithmetic operations.

Unconditional and conditional branching.

Looping procedures.

Subroutines.

Array and matrix operations.

Data files; creation and use.

Section V. General Purpose Applications Software (6 lectures)

Electronic spreadsheets.

Database managers.

Word processing

The two remaining classroom periods are used for midterm exams.

In a course such as this, labs are crucial to students success. They offer the opportunity to design, code, and execute programs, and to see, first-hand, the components of a computer system. Lab topics are listed below.

Week	Topic
1	An introduction to microcomputers
2	An introduction to computer operating systems
3	Program design problem; program flowcharting
4	BASIC problem; input and output
5	BASIC problem; branching and looping
6	BASIC problem; arrays
7	BASIC problem; creating data files
8	Electronic spreadsheet
9	Database manager
10	Word processing

In addition to organized laboratory sections, students are assigned homework exercises. These exercises typically involve description of a simple problem (e.g., tax calculation, grade assignment, enterprise budgeting) for which students must devise and code a computer solution. The exercises are completed during open lab periods offered during the week. The exercises are collected after one or two weeks and graded.

Methodology

The primary objective of this study is to determine the attitude of individual students regarding the use of computers in agriculture, and to test for changes in attitude resulting from the AE 250 experience. To accomplish this objective, two questionnaires were administered; one each on the first and last days of the course. Questionnaires were coded so that the individual's beginning and ending responses could be matched and changes in attitude tested with greater statistical rigor. Questionnaires were administered for four quarters with a total of 379 students submitting both beginning and ending questionnaires.

The mix of students by sex and class rank is described in Table 1. Approximately 66 percent of the respondents were male. Over 48 percent of the students were seniors. Although students are encouraged to enroll as sophomores, the large proportion of seniors is indicative of recent emphasis given to this subject matter by advisors and students alike.

AE 250 serves students from a wide variety of disciplines. Presented in Table 2 is a breakdown of enrollment by class rank and departmental major. The diversity of student population of AE 250 has proved to be a challenge to instructors when devising examples that can be interpreted by all enrolled. Diversity of major interest area is hypothesized to be an important determinant of student attitudes toward computer technology.

The College of Agriculture at The Ohio State University, like most others across the nation, is now attracting a significant number of students from noncommercial farms and urban areas. Table 3 contains information about student backgrounds. Only 28 percent said they were from a commercial farm (arbitrarily defined as one having more than $20,000 gross annual sales). An additional 22 percent were from rural areas other than commercial farms.

Because computer programming involves logical thought processes, often expressed as mathematical equations and numerical comparisons, it was hypothesized that students with backgrounds in mathematics would perform better in this course. Also, coursework in such areas as business, accounting, and statistics may introduce students to potential uses of the computer and, thus, influence expectations of computer usefulness. Clearly, students who have had previous exposure to computer applications or programming will have altered expectations. Summarized in Table 4 are the coursework experiences of students in mathematics, statistics, business, accounting, and computer science. Again, a wide degree of variability is evident among students.

Another question addressed the access of students to a microcomputer at their home or work place. It was hypothesized that access to a computer would result in different attitudes and better performance in the course. Just over 16 percent of the students indicated that they had access to a computer.

Beginning and Ending Attitudes

Two questions on the beginning questionnaire were designed to measure prior attitudes of students toward AE 250 (Table 5).

The first question addressed the primary reason students enrolled. Just over 20 percent suggested the major reason for their enrollment was the college computer literacy requirement. Nearly 9 percent indicated their enrollment was based on the suggestion of a faculty adviser or other individual. An additional 2 percent indicated that they had previous computer coursework and wished to extend their knowledge in this subject area. The remaining individuals, 69 percent, felt the subject matter was important enough to warrant the course.

The second question summarized in Table 5 was included to measure the students' level of apprehension about the course. Students were asked to respond to the statement "I am concerned that I cannot learn fast enough to keep up in this course." Over 25 percent of the students indicated either a strongly agree or agree response. Thirty-six percent either disagreed or strongly disagreed with the statement. The sizable number of students expressing apprehension may also explain the large enrollment of seniors in the course: Perhaps they had delayed enrollment in the course as long as possible.

A series of questions were included on both beginning and ending questionnaires to elicit student attitudes regarding the usefulness of computer technology in agriculture, their specific fields of interest, and future employment activities (Table 6). The first question addressed attitudes about microcomputer technology. Four options were offered: The computer was either an expensive or inexpensive toy or an expensive or inexpensive tool for use in business. Prior to the course, about 5 percent of the respondents felt the computer was an expensive toy, presumably indicating that it held little potential for use in business. Nearly 62 pe ent suggested that the computer was an expensive tool for business. The remainder felt that it was a useful tool and that its cost was not excessive.

A major goal of AE 250 is to survey the uses of the computer in agriculture, past, present, and future, and to make students more aware of its potential. Ending response to the question indicated there was a substantial change in attitudes held. Slightly fewer students reported they viewed the computer only as a toy (Table 6). A larger difference, however, was in the view of the relative cost of the computer compared to other tools of agricultural businesses. Nearly 44 percent of the ending responses reported the computer as an inexpensive tool of business. A paired t-test was used to test the hypothesis that students had changed attitudes from the beginning to the end of the course. In the construction of this test, the difference in response is calculated for each individual, and a comparison is made to determine if the mean of the differences is larger or smaller than zero. Results indicate a change of attitude that is statistically different than zero at the 0.01 level of probability.

Students were asked on both beginning and ending questionnaires to indicate their perception of the cost of a computer system which would be useful in a farm or business. The response choices were given in ranges and are summarized in Table 7. Comparison of beginning and ending responses indicates that, as a result of the course exposure, fewer students choose either the lowest or the highest cost categories. Mean cost responses, calculated using the midpoints of the cost ranges, indicated that the students' ending estimates of cost were higher than their beginning estimates. However, there was lower variability in these responses as indicated by the standard deviation measure. In the opinion of the three course instructors, the ending attitudes were more nearly on target than were the beginning estimates.

A second question, summarized in Table 6, addressed the students perception of their knowledge of computers. Ninety percent indicated either little or no knowledge of computers at the beginning of the course. By comparison, 84 percent felt, by the end of the course, they had achieved moderate knowledge of this technology. A paired t-test was applied to test for change in attitudes. The prior and ending attitudes were statistically different at the 0.01 level of probability.

Reported in Table 8 are the relationships between beginning and ending responses of students. Each cell indicates the paired response of a group of students. For instance, there were 157 students who indicated a very limited knowledge prior to the course, and at course end, a moderate knowledge. Others recognized that the scope of this subject area was larger than previously thought. One student indicated extensive before-class knowledge, but only moderate knowledge at the course end.

The next question addressed students perception of the usefulness of the computer in their chosen discipline. Prior to the course, approximately 31 percent suggested the computer was extremely important in their discipline (Table 6). An additional 54 percent felt that this technology was of moderate importance. Five and ten percent of the responses were "of little importance" and "I have no idea", respectively.

Ending responses to this question did not vary greatly from prior responses. An additional one percent of the respondents felt the computer was of extreme importance in their discipline. Sixty-one percent felt the computer was moderately useful in their discipline. Just over 1 percent were left without a judgment. Application of the paired t-test indicated a change of attitude statistically different than zero at the 0.01 level of probability.

There were both positive and negative adjustments in attitude over the course of the quarter (Table 9). Of the 115 students who initially indicated "extreme importance", 47 indicated the computer was only moderately important in their discipline on the ending questionnaire, and one student reported the computer to be of little importance. Of the 57 students who initially felt the computer was of little value or who had no idea of its usefulness, 8 and 33 students, respectively, indicated on the ending questionnaire an evaluation of extreme and moderate importance.

A similar question addressed student expectations about future uses of computer technology in their employment or business (Table 6). On the initial survey, the statement, "I will be working extensively with computers in my future employment/business", received 12 and 42 percent of all responses in the strongly agree and agree categories, respectively. Additionally, 42 percent responded that they were uncertain if they would be working with computers. About 4 percent disagreed or strongly disagreed with the statement. In the case of the ending questionnaire, an additional 6 percent disagreed or strongly disagreed. It is unclear whether this change in response was due to an altered expectation about the usefulness of the computer in the students' particular career plans, or to a judgment that they, personally, do not wish to work with computers. The paired t-test of change of attitude was not statistically different than zero at the 0.1 level of probability. It is interesting to note that the majority of students indicating either disagree or strongly disagree on the ending questionnaire were from the group who had previously indicated uncertainty on the beginning questionnaire (Table 10).

The last question of Table 6 was included to measure student expectations of AE 250. The question was phrased "I feel that by the end of this course I will have the necessary knowledge to do the majority of my future computer programming". Forty-one percent indicated agree or strongly agree to this statement. Such responses are, in the estimation of these instructors, overly optimistic. Computer solutions to realistic business problems often involve major programming efforts, are very time consuming and require substantial programming knowledge. Our goals in the course were to make students more aware of the potentials this technology holds for use in agriculture, to provide enough programming experience to facilitate the determination of those applications suited to computer solution and facilitate choosing from existing software or communicating with a programmer in program design.

Ending questionnaire results indicate that we were not entirely successful in this regard (Table 6). Nearly 43 percent either strongly agreed or agreed with this statement. This was only a slightly larger percentage than on the first questionnaire. There was, however, a substantially larger group who indicated disagree or strongly disagree to the statement. The difference in beginning and ending attitudes were statistically different than zero at the 0.01 probability level as tested with the paired t-statistic.

Indicated in Table 11 is the movement in student attitudes between the before- and after-course survey. Again, the most substantial movement in attitudes was in the group which was initially uncertain. It appears that those students who initially indicated agree or strongly agree accounted for 54 percent of those who so responded on the ending survey.

Both beginning and ending questionnaires included questions which asked students to rank, in the order most expected to benefit the student in the future, five computer applications (Table 12). Comparison of before- and after-course responses indicated essentially no difference in the rankings.

Two questions were included on the ending questionnaire which asked students to evaluate changes in their attitudes over the course of the quarter (Table 13). The first question asked students to indicate whether they had, at the beginning of the class, overestimated, underestimated, or accurately estimated the usefulness of computers in agriculture. Over 50 percent indicated they had underestimated computer usefulness, while only 3 percent reported that they had overestimated its usefulness.

The second question asked students to indicate whether they had, at the beginning of the quarter, overestimated, underestimated, or accurately estimated the ability of an individual to develop business software. Sixty-four percent responded that they had underestimated their ability to develop software, and nearly 13 percent indicated that they had overestimated this ability.

Student Performance and Course Evaluation

This section deals with student course performance and their evaluation of the course. Statistical analysis of performance and evaluation by subgroups of students will be reported.

Reported in Table 14 are the final class grades on a percentage basis. Class grade ranges reported are those typically used for A, B, C, D, and E grades, respectively. University rules in place during the first two offerings of AE 250 reported here allowed students to drop courses through the 7th week of classes. This was modified prior to the last two offerings to allow courses to be dropped only through the 3rd week. The former rule likely decreased the number of D and E grades that would have occurred had the latter rule been in place throughout the entire period.

The ending questionnaire incorporated three course evaluation statements prefaced with the following statement: "It's your chance to grade AE 250. For each of the following goals, rate the performance of this course. Grades should range from 0 to 100, where 0 indicates a failing effort, 100 indicates excellence, and 50 is an average level of performance". The text of the individual goal statements and average evaluation rating are given in Table 15. Scores on all three course objectives ranged from 0 to 100. Student rating was highest for objective 3, apparently showing good support for the broad, survey nature of the course.

Grade performance and course evaluation statements are compared by sex in Table 16. A statistical test of difference of mean responses for the two groups also is reported. In all cases, neither the means nor the measure of dispersion were significantly different. The difference in responses for the two groups were not statistically different than zero at the 90 percent confidence interval.

A similar comparison was made by grouping students into those who did or did not have access to a computer at home or work (Table 17). Again, the means and standard deviations for the two groups were quite similar, and the test of the hypothesis of difference of means for the two groups could not be accepted at the 90 percent confidence interval.

There were 29 individuals who reported previous coursework in computer science. Table 18 contains a comparison of course evaluation and student performance in the course for the groups of students who had no previous coursework in computers with those 29 who had. A test of the means for these two groups indicated no significant difference in course evaluations. However, students with previous computer science coursework did perform significantly (at the 0.05 level of probability) better than those who had no such coursework.

The attitudes of students toward AE 250 at the beginning of the course was hypothesized to be an important determinant of students' performance and course evaluation. The results of this comparison are reported in Table 19. The measure of beginning attitude used was the response to the question of why students had enrolled in AE 250. Those who indicated they were in the course only because of the college requirement were placed in the "negative attitude" group. Those who indicated either the desire to expand their knowledge in the computer science area or who reported that it was valuable subject matter, were placed in the "positive attitude" group. The for these groups were significantly different for 2 of the 5 evaluation goals, and for class grade performance.

A similar comparison was made of students who were and were not apprehensive about AE 250 prior to the beginning of the course (Table 20). Those students who responded agree or strongly agree to the statement "I am concerned that I cannot learn fast enough to keep up in this class" were placed in the apprehensive group. Those students who responded disagree or strongly disagree were considered not apprehensive. The means for these two groups were significantly different for all evaluation statements and the course grade performance. Apprehensive students did more poorly in the course and gave lower evaluation reports.

Finally, in Table 21, a comparison of grade performance and course evaluation is made by departmental major. Means and standard deviations were not largely different for most of the majors. Only the mean for Horticulture majors was statistically different (0.05 level of probability) than the mean for the entire sample.

Summary

Changes in attitude of students in the College of Agriculture as result of enrollment in AE 250, a "computer literacy" course, were measured using paired beginning and ending questionnaires. Results indicated significant changes in attitude. At course end, students reported higher respect for the usefulness of the computer in agriculture and their particular discipline. The majority indicated that, at the beginning of the course, they had underestimated both the usefulness of the computer in agriculture and their ability to write software. Beginning attitude and level of apprehension about the course were found to be significant determinants of student performance and evaluation of the course.

Bibliography

[1] Huntington, John F. "Computer Literacy: Selecting Courseware" Educational Technology 22(October 1982): 34-5.

[2] Innskeep,James E. Jr. "Computer Literacy: What It Is and Why We Need It" Curriculum Review 21(May 1982): 138-41.

[3] Johnson, Mildred Fitzgerald. "Computer Literacy: What Is It" Business Education Forum 35(December 1980): 18-22.

[4] Kitch, Dale. "Computer Literacy: The Fourth Basic Skill" Business Education Forum 35(November 1980): 22-3.

[5] Masat, Francis E. Computer Literacy in Higher Education AAHE-ERIC/Higher Education Research Report No. 6, 1981.

[6] Molnar, Andrew R. "The Next Great Crisis in American Education: Computer Literacy." Journal of Educational Technology 7(January 1979): 275-87.

[7] Moritz, Michael, Madeline Nash, and Peter Stoler, "The Computer Moves In," Time, January 3, 1983, Vol. 121, No. 1, pp. 14-24.

[8] Sonka, Steven T. Computers in Farming, Selection and Use,

New York: McGraw-Hill Book Company, 1983

[9] Taylor, Reed D., and Michael W. Woolverton. "Teaching Computer Technology for Agriculture Using Programmable Calculators." NACTA Journal, June 1980, Vol. XXIV, No.2, pp. 36-41.

[10] Turner, Judith Axler. "Ohio State Eyes 'Computer Literacy': Who Needs It? Who Should Teach It?" The Chronicle of Higher Education 11 January 1984, p. 1.

Table 1. AE 250 Student Population by Sex and Class Rank.

Sex	Freshman	Sophomore	Junior	Senior	Graduate	Other	Total
			(Frequency)				
Male	4	35	85	118	4	4	250
Female	0	14	46	65	1	3	129
Total	4	49	131	183	5	7	379

Class Rank

a. Includes continuing education and non degree students.

Table 2. AE 250 Student Population by Academic Major and Class Rank.

Major	Fresh.	Soph.	Junior	Senior	Grad.	Other	Total
			(Frequency)				
Ag. Economics	1	21	42	20	0	2	86
Animal Science	1	12	28	44	1	1	87
Ag. Education	1	2	16	30	0	0	49
Agronomy	0	6	9	26	3	0	44
Plant Pathology	0	0	2	6	0	0	8
Dairy Science	1	1	12	13	0	2	29
Horticulture	0	4	11	21	1	1	38
Poultry Science	0	0	1	4	0	0	5
Ag. Mechanization and Systems	0	3	5	5	0	0	13
Non-agricultural	0	0	4	9	0	1	14
Total	4	49	130	178	5	7	373

Class Rank

a. Includes continuing education and non degree students.

Table 3. AE 250 Student Population by Background.

Raised Principally:	Relative Frequency
In the city (5000 + population)	27.3
In a small town (under 5000)	8.6
On a commercial farm	28.3
On a noncommercial farm	22.5
In a rural area but not a farm	13.4

Table 4. Previous coursework in Math, Accounting, Business, Statistics and Computer Science.

Hours	Math	Statistics	Accounting	Business	Computers
			Course		
			(Relative Frequency)		
0	0.53	57.00	59.37	62.53	92.35
1 - 5	18.73	40.11	21.90	14.25	6.86
6 - 10	43.80	2.38	17.68	10.29	0.53
11 - 15	30.08	0.53	1.06	6.60	0
16 - 20	5.01	0	0	4.48	0
21 - 25	1.32	0	0	0.26	0.26
More than 25	0.53	0	0	1.58	0

Table 5. Before-Class Attitudes of AE 250 Students.

Remark	Relative Frequency
I am in this class:	
Only because of requirement	20.05
My advisor recommended it	8.76
I feel that it is important for future	68.93
I want to extend knowledge beyond that developed in previous computer courses	2.26
I am concerned that I cannot learn fast enough to keep up in this course.	
Strongly agree	5.11
Agree	17.33
Uncertain or neutral	40.91
Disagree	30.97
Strongly disagree	5.68

Table 6. Before- and After-Class Attitudes of AE 250 Students.

Remark	Relative Frequency Prior	Relative Frequency Ending
My current opinion concerning microcomputers is:		
An expensive toy	4.92	2.13
An inexpensive toy	0	0.53
An expensive tool of business	61.75	53.72
An inexpensive tool of business	33.33	43.62
My computer knowledge is:		
Extensive	0.26	2.90
Moderate	9.52	84.17
Very limited	49.47	12.93
None	40.74	--
My evaluation of the usefulness of the computer in my chosen area is:		
Extreme importance	30.93	31.75
Moderate importance	53.87	61.11
Little importance	5.07	5.82
No idea	10.13	1.32
I will be working extensively with computers in my future employment/business.		
Strongly agree	12.43	13.79
Agree	41.53	42.44
Uncertain or neutral	42.06	33.95
Disagree	3.70	7.43
Strongly disagree	0.26	2.38
By the end of this course, I will have the necessary knowledge to do the majority of my future computer programming.		
Strongly agree	3.7	1.06
Agree	37.57	41.76
Uncertain or neutral	51.85	34.04
Disagree	6.08	19.68
Strongly disagree	0.53	3.46

Table 7. Cost of a Computer System Which Would be Useful in a Farm or Business Setting.

Cost Range	Relative Frequency Prior	Relative Frequency Ending
Under $1,000	6.14	2.68
$1,000 - 2,000	22.45	16.89
$2,000 - 4,000	38.19	32.44
$4,000 - 6,000	17.20	26.54
$6,000 - 8,000	8.16	10.18
$8,000 - 10,000	3.50	6.97
$10,000 - 15,000	2.33	2.95
$15,000 - 20,000	0.87	0.80
Over $20,000	0.87	0.54
Mean	$3,913	$4,538
Standard Deviation	3,112	3,042

a. Mean and standard deviation are calculated using the midpoint for each class, and $1,000 and $20,000 for the end classes.

Table 8. Comparison of Before- and After-Class Attitudes: "I Would consider my computer knowledge at the beginning of (at the end of) this class to be".

Before Class Attitude	After Class Attitude: Extensive	Moderate	Very Limited	Total
	(Frequency)			
Extensive	0	1	0	1
Moderate	2	33	1	36
Very Limited	8	157	22	187
None	0	128	26	154
Total	10	319	49	378

Table 9. Comparison of Before- and After-Class Attitudes: "My Evaluation of the usefullness of the computer in my chosen area is".

Before Class Attitude	After Class Attitude: Extreme Importance	Moderate Importance	Little Importance	No Idea	Total
	(Frequency)				
Extreme Importance	67	47	1	0	115
Moderate Importance	43	149	6	4	202
Little importance	0	8	11	0	19
I have no idea	8	25	4	1	38
Total	118	229	22	5	375

Table 10. Comparison of Before- and After-Class Attitudes: "I Feel That I Will be Working With Computers Extensively in my Future Employment/Business".

Before Class Attitude	After Class Attitude: Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree	Total
			(Frequency)			
Strongly Agree	24	17	5	0	0	46
Agree	22	94	38	3	0	157
Uncertain	5	46	81	19	7	158
Disagree	0	3	4	5	2	14
Strongly Disagree	0	0	0	1	0	0
Total	51	160	128	26	9	376

Table 11. Comparison of Before- and After-Class Attitudes: The Ability of the student to do the majority of their future computer programming.

Before Class Attitude	After Class Attitude: Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree	Total
			(Frequency)			
Strongly Agree	2	8	5	0	0	15
Agree	1	[illegible]	[illegible]	16	[illegible]	[illegible]
Uncertain	1	70	72	45	6	194
Disagree	0	2	5	11	0	23
Strongly Disagree	0	0	0	2	0	2
Total	4	156	128	74	13	375

Table 12. Student Ranking of Future Computer Uses.

Computer Application	Prior	After
Accounting or record keeping	1	1
Word processing	4	4
Process control	4	5
Database or information services	2	2
Use of management aid software	3	3
Other	6	6

Table 13. Student Self-Evaluation of Attitude Changes over the Course of the Quarter.

Remark	ative Frequency
At the beginning of this class:	
I overestimated the usefulness of the computer in agriculture.	3.20
I underestimated the usefulness of the computer in agriculture.	50.93
I accurately estimated tne usefulness of the computer in agriculture.	45.87
At the beginning of this class:	
I overestimated the ability of an individual to develop business software	12.80
I underestimated the ability of an individual to develop business software	64.00
I accurately estimated the ability of an individual to develop business software	23.20

Table 14. Grades awarded AE 250 students.

Class Grade	Relative Frequency
90 - 100	25.69
80 - 89	40.41
70 - 79	26.03
60 - 69	7.19
Under 60	0.68
Mean	82.87
Standard Deviation	8.79

Table 15. Student evaluation of Agricultural Economics 250.

Goal	Mean	Std. Dev.
1. Helping students understand the future role of computer technology in agriculture	73.58	20.65
2. Providing students with the knowledge of computers required for a successful future in agriculture	71.91	21.90
3. Providing students with basic computer "literacy"	84.54	16.98

a. Students were instructed to give a score for each of the above goals. Scores ranged from 0 to 100, with 0 indicating a failing effort and 100 indicating excellence.

Table 16. Comparison of Student Evaluations and Performance by Sex.

	Sex				Difference
	Male		Female		of
Measure	Mean	Std. Dev.	Mean	Std. Dev.	Means (Z-Score)
Goal 1.	73.67	20.11	73.44	21.79	0.088
Goal 2.	72.05	21.78	71.68	22.26	0.136
Goal 3.	85.08	16.89	83.44	17.19	0.777
Course Grade	82.96	8.72	82.66	8.98	0.271

* Different from zero at the 0.10 level of probability
** Different from zero at the 0.05 level of probability
*** Different from zero at the 0.01 level of probability

Table 17. Comparison of Student Evaluations and Performance by Access to Microcomputers at Home or Work.

	Access				Difference
	No Access		With Access		of
Measure	Mean	Std. Dev.	Mean	Std. Dev.	Means (Z-Score)
Goal 1.	73.51	20.95	73.43	19.73	0.026
Goal 2.	71.45	21.59	73.39	23.39	-0.595
Goal 3.	84.34	17.37	84.93	15.48	-0.233
Course Grade	82.94	8.72	82.62	9.31	0.242

* Different from zero at the 0.10 level of probability
** Different from zero at the 0.05 level of probability
*** Different from zero at the 0.01 level of probability

Table 18. Comparison of Student Evaluations and Performance by Previous Computer Science Course Experience.

Measure	Previous Computer Courses Mean	Previous Computer Courses Std. Dev.	No Previous Computer Courses Mean	No Previous Computer Courses Std. Dev.	Difference of Means (Z-Score)
Goal 1.	70.58	20.84	73.87	20.64	-0.769
Goal 2.	72.88	21.96	71.82	21.93	0.235
Goal 3.	84.23	18.25	84.57	16.89	-0.091
Course Grade	86.24	7.38	82.55	8.86	2.347 **

* Different from zero at the 0.10 level of probability
** Different from zero at the 0.05 level of probability
*** Different from zero at the 0.01 level of probability

Table 19. Comparison of Student Evaluations and Performance by Beginning Attitude.

Measure	Negative Attitude Mean	Negative Attitude Std. Dev.	Positive Attitude Mean	Positive Attitude Std. Dev.	Difference of Means (Z-Score)
Goal 1.	70.89	23.88	74.40	19.70	-0.987
Goal 2.	63.52	25.93	73.42	20.84	-2.573 **
Goal 3.	77.68	18.87	86.86	15.07	-3.281 ***
Course Grade	79.08	8.34	83.63	8.58	-3.488 ***

* Different from zero at the 0.10 level of probability
** Different from zero at the 0.05 level of probability
*** Different from zero at the 0.01 level of probability

Table 20. Comparison of Student Evaluations and Performance by Degree of Apprehension about AE 250.

Measure	Apprehensive Mean	Apprehensive Std. Dev.	Not Apprehensive Mean	Not Apprehensive Std. Dev.	Difference of Means (Z-Score)
Goal 1.	67.62	24.33	74.48	20.17	-1.848 *
Goal 2.	65.44	24.85	73.26	22.17	-2.016 **
Goal 3.	80.46	21.40	88.52	14.31	-2.607 ***
Course Grade	78.80	8.73	85.63	8.35	-4.861 ***

* Different from zero at the 0.10 level of probability
** Different from zero at the 0.05 level of probability
*** Different from zero at the 0.01 level of probability

Table 21. Comparison of Student Evaluations and Performance by Departmental Major.

Measure	N	Goal 1 Mean	Goal 1 Std. Dev.	Goal 2 Mean	Goal 2 Std. Dev.	Goal 3 Mean	Goal 3 Std. Dev.	Grade Mean	Grade Std. Dev.
Ag Econ	71	73.3	20.2	73.4	19.8	85.3	18.5	83.4	9.2
An Science	64	74.0	18.7	73.5	17.2	83.4	14.8	83.4	9.0
Ag Ed	38	75.9	19.8	73.3	23.2	85.1	13.0	83.7	7.6
Agronomy	33	72.4	24.6	71.5	24.8	86.7	20.0	81.9	8.5
Plant Path	5	89.0	10.8	86.0	8.2	92.0	8.4	79.2	7.5
Dairy Sc	22	75.9	12.2	67.2	22.8	80.7	18.9	84.2	10.5
Hort	33	65.1*	26.7	63.2*	27.0	81.6	19.2	79.4*	8.9
Poultry Sc	4	87.5	13.2	77.5	19.4	86.2	17.0	78.0	11.2
Ag Mech	11	77.7	14.4	75.4	23.3	85.0	20.1	82.3	7.3
Other	13	74.2	23.7	70.8	28.3	87.7	13.3	85.4	7.5

* Statistically different than the mean of the entire sample at the 0.05 level of probability.